

Owens, Kim

From: Shaw, Hanh
Sent: Friday, May 08, 2015 1:17 PM
To: Owens, Kim
Subject: Temp info
Attachments: Temperature.docx

—

Environmental Assessment

Shell Offshore Inc.

2012 Revised Outer Continental Shelf Lease Exploration Plan

Camden Bay, Beaufort Sea, Alaska

August 2011

(EPA_NPDES_AR_013393)

**Table 5 Water column measurements in Camden Bay, Alaska, over four days in August 2008
(after Trefry and Trocine, 2009)**

Variable	Surface Water	Bottom Water (>20m)
Salinity (ppt)	25.3 to 29.2	29.7 to 31.7
Temperature (°C)	4.3 to 6.4	0.24 to 0.38
Turbidity (NTU)	1.8 to 2.6	2.0 to 3.0
pH	7.8 to 8.4	7.7 to 8.0
Dissolved Oxygen (mg/L)	9.5 to 10.4	11 to 12.2
Oxygen Saturation (%)	89 to 98	96 to 104
TSS (mg/L)	0.26 ± 0.13	0.73 ± 0.31
POC (mg/L)	0.066 ± 0.038	0.081 ± 0.0.025
POC as % of TSS	25.7 ± 6.4	10.0 ± 3.5

(EPA_NPDES_AR_013422)

Seawater withdrawn for use as non-contact cooling water would be discharged from the drillship (at a depth of 41 ft (12.5 m) or 19.6 ft (6.0 m)) at temperatures above-ambient sea temperature. These thermal wastewaters would discharge into the sea above the stratification for salinity and temperature (found at approximately 20m) and would likely mix quickly. It is estimated that the thermal discharge would affect water temperatures within an area 164 ft long and 13 ft wide at the drillship *Discoverer* and 256 ft long and 16 ft wide at the drillship *Kulluk* (Shell, 2011a).

Revised Exploration Plan

Camden Bay, Beaufort Sea, Alaska

May 2011

(EPA_NPDES_AR_016105 and 016107)

Kulluk Cooling Water Modeling

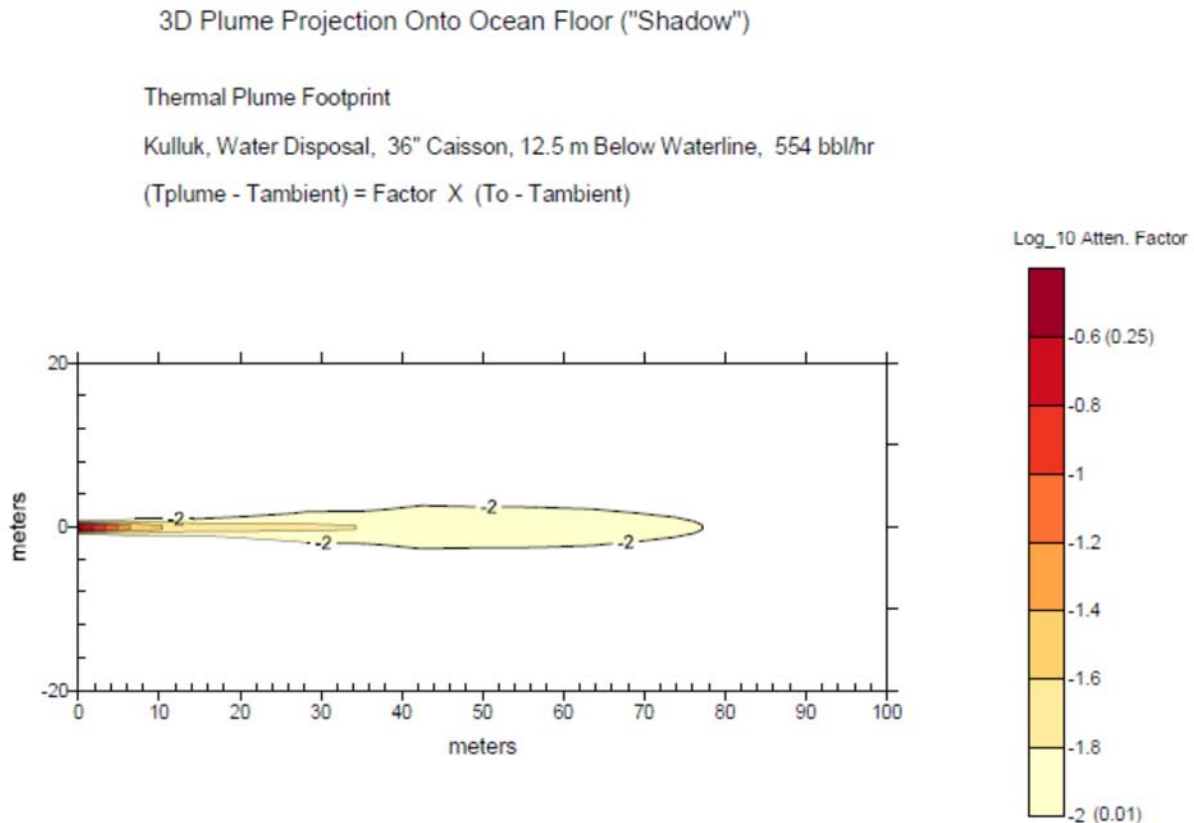
Shell has modeled the cooling water discharge from the *Kulluk*. A detailed analysis of the dispersion of cooling water into the water column is found in the EIA (Appendix F).

Shell has modeled the cooling water discharge of 13,178 bbl per day (plus a minor amount of water discharge from other onboard system 125 bbl per day) from the *Kulluk*. The modeling shows that the cooling water reaches ambient seawater temperatures a relatively short distance from the outfall.

The cooling water from the *Kulluk* will be released through a 36-in. (91 cm) disposal caisson at a depth of 41 ft (12.5 m) below the ocean surface at an average rate of 554 bbl/hr. The discharged water creates a plume approximately 256 ft (78 m) in length and up to 16 ft (5 m)

wide (Figure 6c-). At the edges of this plume, the cooling water will have reached ambient seawater temperatures.

Figure 6.c-1 Cooling Water Plume from the 36-in. Disposal Caisson on the *Kulluk*



***Discoverer* Cooling Water Modeling**

Shell has modeled the cooling water discharge of 45,000 bbl per day from the *Discoverer*. The modeling shows that the cooling water reaches ambient seawater temperatures a relatively short distance from the outfall.

The cooling water from the *Discoverer* will be released at five outfalls each located 11.2 ft (3.4 m) above the surface of the ocean. Two of the outfalls are through 6-in. (15.2 cm) diameter pipe and three outfalls are from 2-in. (5.1 cm) diameter pipes. The flow rate through each 6-in. (15.2 cm) pipe is approximately 562.5 bbl/hr and approximately 250 bbl/hr through each 2-in. (5.1 cm) pipe.

The cooling water coming out of each 6-in. (15.2 cm) outfall attenuates to a plume approximately 164 ft (50m) in length and 13 ft (4m) wide (Figure 6c-2). The cooling water from each 2-in. (5.1 cm) outfall results in a plume 30 ft (9 m) and 305 ft (1-1.5 m) wide (Figure 6c-3).

At the edges of both plumes, the cooling water will have reached ambient seawater temperature.

Figure 6.c-2 Cooling Water Plume From Each 6-in. Outfall on the *Discoverer*

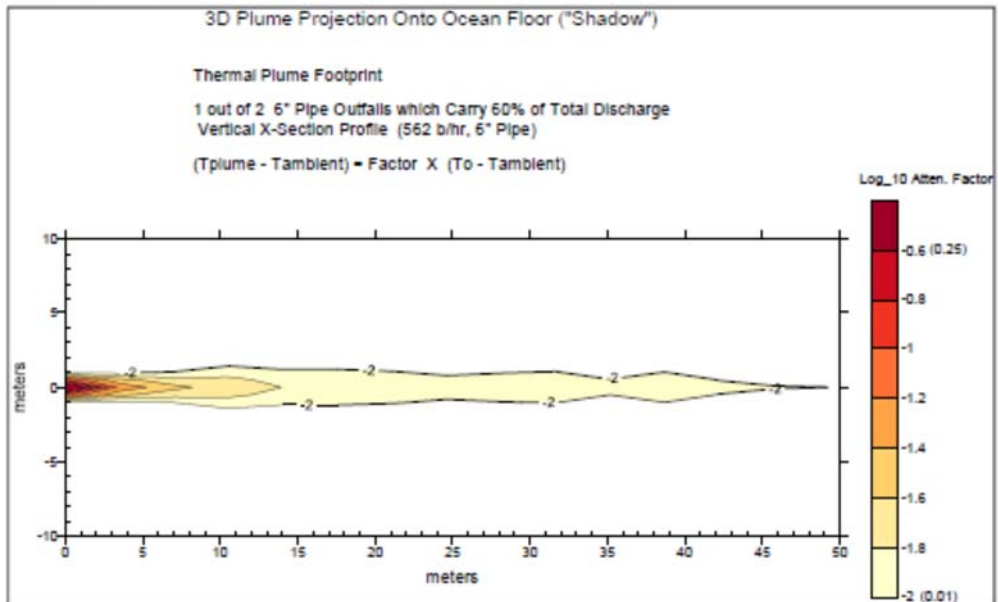


Figure 6c-3 Cooling Water Plume From Each 2-in. Outfall on the *Discoverer*

